UNITED STATES ENVIRONMENTAL PROTECTION AG

SUBJECT: Trip Report for Chemical Technology Delegation to the Soviet Union 6-14 - 6-28

FROM: Andrew Paretti, Head of Delegation, Office of Water Program Operations WH-447

TO: Fitzhugh Green, Associate Administrator for International Activities A-106

THRU: John T. Rhett, Deputy Assistant Administrator for Water Program Operations WH-446

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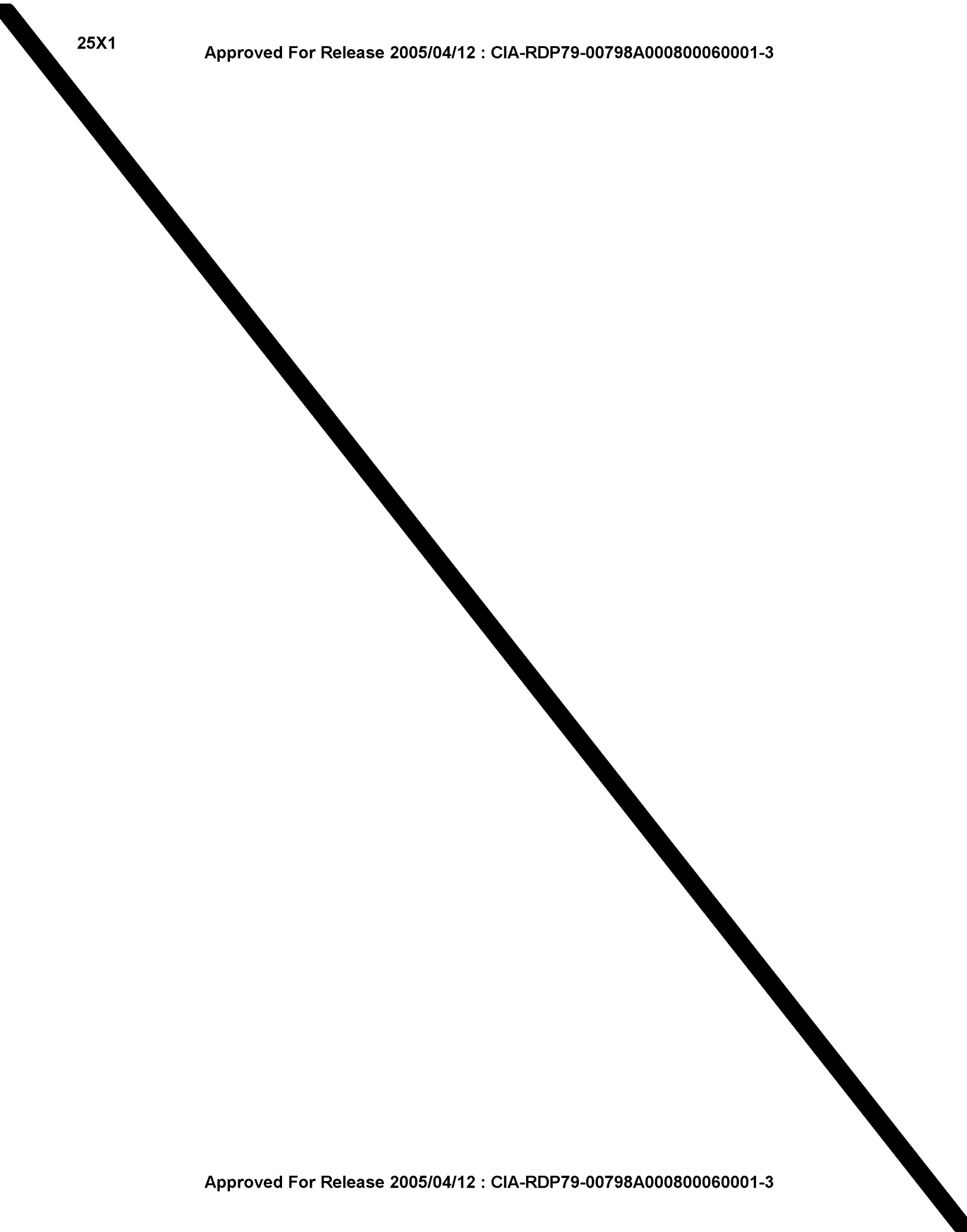
As part of Project II-2.2 - Prevention of Water Pollution from Industrial Sources, the Ministry of the Chemical Industry of the Soviet Union hosted the Environmental Protection Agency official delegation from 6-14 - 6-28, 1975. Their participants were headed by Vice Minister K. K. Tcherednichenko. His personal interest was invaluable and his position in the Ministry insured that all possible courtesies were received by the delegation. He personally chaired our first and last conference in Moscow and hosted our welcome aboard and final dinner reception.

Of the industries covered to date in the Soviet Union, namely Pulp and Paper, Ferrous Metallurgy, and Chemical Industry, I would have to rank Chemical Industry last as far as wastewater treatment practice is concerned. When we complete the Ministry of Oil Refining and Petro Chemical Industries in October, we can make a more definitive rating as regards the four industry sub-groups and their wastewater treatment expertise.

Though beyond our control, only two of our scheduled visits covered wastewater treatment plants. The one at Kiev chemical fiber complex was shut down at the time of our visit. The one at Almalyak was a complete closed cycle at this fertilizer complex. A true zero discharge but obviously very costly. Because their raw material supply of phosphrite rock is of such poor quality they were forced into this closed system as their wastewater treatment technology was not capable of removing the impurities in the rock on any sensible economic basis. The raw material was loaded with sulphur, calcium, and manganese, amongst other impurities and was and is a real problem.

ENVIRONMENT
Air pollution - Industrial Sources

EPA Form 1320-6 (Rev. 6-72)



Approved For Release 2005/04/12 : CIA-RDP79-00798A000800060001-3

So that the industry specialists would see more of the Soviet state of the art in wastewater treatment, I was able to get the Soviets to schedule visits to two municipal plants, both of which handled effluents from chemical plants that discharged primarily organic wastes into the effluent. These chemical effluents represented more than 50% of the input into the municipal plants. They were a good example of the municipal systems in the major Soviet cities and they are on a par with our own municipal facilities up to and including secondary treatment. From a technical point of view it was worth cancelling certain cultural visits to afford this opportunity to our industry representatives.

One of the biggest differences between our system and theirs is the use of design and research institutes. As noted we visited four such institutes (Fertilizer, Artificial Fibers, Domestic and Household Chemistry and Synthetic Fibers). They afford a central control over a whole industry. As a result there is usually a common design wastewater treatment plant for a particular manufacturing process, that is identical throughout the Soviet Union. In the United States where each company competes one with another, all develop varying types of treatment plants based on the best thinking of their various environmental engineering departments. There are advantages to both systems, but I think our plan is superior. Namely, establish the required guidelines that must be met but allow the manner of attaining that result to be completely clear of the bureaucratic process. This prevents locking in on a single design with the inherent risk of stifling the need for better and more economical designs--a fault that seems to be prevalent in the Soviet Union's system. If something new is developed, it is a monumental problem to change because of their single design concept. On the plus side, however, is the fact that these institutes employ in excess of 1,000 people each, with over half being engineers and scientists. Such large pools of talent should obviously generate many new approaches for preliminary pilot plant work-up.

The Ministry of Chemical Industry is very interested in continuing this technical exchange. They have come up with a detailed proposal for the year 1976 which I have incorporated as an appendix to the protocol. It is the opinion of the delegation that the technical exchange should be continued through 1976 with the Soviet Ministry of the Chemical Industry.

As is usual on these trips we received many papers on various technical subjects. One that seemed particularly apropos, (On The State of Water Use and Effluent Treatment in the Manufacture of Man-Made Fibers) I am also attaching to the report. It is indicative of the level of sophistication that the Soviets are capable of attaining. The tables are being translated into English but I did not wish to hold up the trip report pending the receipt of the translations which is usually a slow process.

In many instances, the technical expertise developed by the institutes is not carried through at the complex. Priorities as set up in their five year plans are binding. A prime example of this--something which is very obvious to the naked eye--is air pollution abatement. It has not been given the same priority as water pollution up till this point in time. As a result air pollution will get nominal attention until included in a five year plan.

There is every indication that our Soviet counterparts are still putting maximum support behind the Train/Israel Environmental Agreement reciprocal exchange program and that the policy makers encourage this policy. As usual detente and cultural exchange as well as the technological programs continue to be stressed.

M E M O R A N D U M

on the visit to the USSR (15-28 June 1975) of the U.S. specialists from the Chemical Industry to study methods of prevention of water pollution under Project II-22 of the Environmental Agreement entitled "Prevention of water pollution from Industrial and Municipal Sources".

Cooperation development between the USSR and USA in the field of environmental protection in chemical industry is being realized in compliance with the Agreement signed in Moscow on May 23 d. 1972 by Mr. Nikolai V.Podgorni - Chairman of the Presidium of the Supreme Soviet of the USSR and Mr. Richard Nixon - the then President of the USA.

The beginning of cooperation in the field of environmental protection between the Ministry for Chemical industry of the USSR (MCI) and the US organizations within the framework of the USSR-US Joint Committee on Cooperation in the field of Environmental Protection was begun with the visit of the Soviet delegation to the USA (8- 18th September 1974). The Soviet delegation (consisting of 4 people) headed by Mr. Konstantin K. Tcherednichenko - Vice-Minister for chemical industry paid a visit to the USA in compliance with the Memorandum of the 2nd Session of the Soviet American Commission (Nov 13 Washington, D.C.) The delegation visited a number of industrial facilities and scientific- research centers of some US companies, i.e.: American Cyanamid Company, Colgate- Palmolive Company, Union Carbide Corporation, Tennessee Valley Authority and FMC Corporation where they familiarized themselves with the methods of treatment and control of the effluents at synthetic detergent,

phosphate fertilizer and synthetic fiber plants. The Delegation met with the senior specialists of the Environmental Protection Agency in Washington, D.C. and discussed with them the prospects for the development of further cooperation.

The return visit of the US delegation took place 15-28th June 1975 in compliance with the Memorandum of the 3d Session of the Soviet-American Commission. The US delegation consisting of 5 people was headed by Mr. Andrew Paretti - Consultant, Water Program Operations, Environmental Protection Agency. The lists of the US and Soviet delegates are presented in appendices 1 and 2. In accordance with the pre-agreed program the US delegation visited a number of MCI research institutes and industrial facilities where it was introduced to various ways and means of environmental protection at fertilizer, household chemistry and chemical fiber plants. The US delegation also visited municipal effluent (waste water) treatment plants in Moscow and Kalinin. These facilities treat effluents from industrial plants including those of the chemical industry.

The program of the US delegation visits is presented in appendix 3.

While touring various MCI facilities and establishments and discussing environmental protection problems with the Soviet specialists, the US delegation was presented certain informative literature.

On the 16th of June, 1975 the US delegation visited the All-Union Scientific Research Institute for Fertilizers and Insecto-fungicides named after Ya.V.Samoilov (NIUIF)

and met with professor V.M.Borisov - director of the Institute

and a group of leading specialists in the field of environmental protection. The meeting and discussion was attended by Mrs. L.N. Arkhipova (laboratory head), Mr. A.D. Mikhailin (head of the department), Mr. V.V. Ivanov (group leader), Mrs. V.D. Troitskaya (group leader) and Mrs. L.G. Pominova (senior engineer).

In the course of the meeting prof. Borisov familiarized the US specialists with the works carried out in the Institute in the field of environmental protection. The following problems were discussed:

1) Recovery of fluorine gases when producing wet process phosphoric acid and NPK fertilizers at the Soviet and US industrial facilities. It was established after exchange of opinions that fluorine was recovered at the Soviet as well as at the US production facilities by sodium or calcium alkaline solutions resulting in fluorides of these salts. Venturi tubes and wet scrubbers are used as absorbers in the USSR as well as in the USA.

2) Phospho- gypsum by-products when producing phosphate fertilizers.

This problem has not been solved so far in the USSR and USA. Economic methods of phospho-gypsum conversion into sulfuric acid and construction materials have not been developed. At the present time this product is stored in specially allocated areas. Phospho-gypsum storage during long periods of the time causes environmental pollution (soil salinization and dusting).

3) Sulfur dioxide recovery from waste gases at sulfuric acid production facilities.

The US specialists have stated that sulfur dioxide content in waste gases is markedly reduced at the expense of double absorption. Pyrite cinder problem is non-existant in the USA, since elementary sulfur is used in sulfuric acid production. Substantial amounts of Soviet sulfuric acid are produced from pyrites, thus leading to the problem of pyrite cinder disposal.

4) Possible ways and means of reducing air pollution.

These problems are being tackled in the USA at present by improving absorption equipment and utilizing ion exchange resins and filtering materials for final treatment. High smoke-stacks are still being built in the USSR, however, (when burning sulfur containing coals and in non-ferrous metallurgy) for dissipating harmful discharges in high atmospheric layers.

5) Pure water consumption for technological processes.

A closed-circuit recycle system has been realized at the Almalyk chemical complex for ammonium phosphate production. The US specialists have pointed out that the US companies do not have a uniform rate of pure water consumption for any technological process. On the 17th of June 1975 the US delegation visited the All-Union Scientific Research Institute of Artificial Fibers in Mytishi (VNIIV).

The meeting and discussion were attended by I.G. Shimko-director of the Institute, professor A.B.Rakshver, prof. E.M. Mogilevsuy. I.Z.Aifer - head of the department,G.G.Finger - section leader,Mr. V.P.Kim - deputy head of environmental protection department. Mr. I.G.Shimko described basic trends of r & d institute and made a presentation concerning the work carried

out in the Institute in the field of environmental protection.

Messrs. Mogilevsky and Finger made special presentations on environmental protection and development of various methods and equipment for effluent (waste water) treatment. The US specialists visited section 1 of the experimental production facility and familiarized themselves with the experimental manufacture at a textile rayon filament, they also visited an environmental protection exhibition and the Institute computer center. Both sides noted the usefulness of the discussion and expediency of further development of the contacts.

On the 18th of June 1975 the US delegation visited in Kiev the All-Union Scientific-Research and Design Institute of household Chemistry (VNIIKHIMPROYEKT). The meeting and discussion were attended by Mr. G.G.Poturidis- chief engineer of the Institute, mr. B.P. Kotelnikov - deputy director for research, mr. O.I.Lavrentyev- head of sanitary engineering department, mr. A.A.Tchumak - head of technology department, mr. A.P.Shevchenko - head of a foreign relations section, mrs. R.S.Svetlova - head of laboratory for effluents (waste waters) and gas discharges of Tula branch of the Institute and mr. V.N. Maltsev - raw material laboratory head.

Environmental protection problems pertaining to the manufacture at synthetic detergents were discussed during the meeting, particularly new scientific - research trends aimed at polyphosphate replacement in detergent powders and electrostatic field application for cleaning gas discharges. The US specialists were taken round the Institute R & D laboratories for powdered, and liquid detergents. During the meeting the

US delegation was handed over a list of published papers on environmental protection pertaining to detergent production.

On the 19th of June 1975 the US delegation visited a leading production establishment of the Ukrainian household chemistry, industrial corporation "Ukrbitkhim".

The meeting was attended by Yu.F.Osadchi - director general, mr. E.E. Vetsker - deputy director general, mr. N.A. Masmokov - deputy chief engineer, mr. V.V. Korotum - production department head, mr. G.I. Vishnevsky - chief technologists

At the meeting the director general described the Corporation activity, the products made by the latter and the actions taken in the field of environmental protection at the complexes and plants of the Corporation. The US delegation visited package making sections, filling section (for liquid detergents, hair lacquer), storage facility and an instrumentation shop.

On the 20th of June 1975 the US delegation visited Kiev chemical fiber complex and familiarized themselves with various measures taken in the field of environmental protection.

The meeting was attended by mr. A.I.Maltchevsky - the complex director, mr. J.N. Zagrekov - deputy chief of the technology department, mrs. L.K.Tchirikina - head of scientific - technical information department.

Mr. A.I. Maltchevsky described the range of products made by the complex and the complex activity on environmental protection. The US specialists visited carbon disulfide recovery plant and toured round effluent (waste water) treatment complex under construction comprising mechanical - chemical cleaning of acid, alkaline, rayon and slime (slurry) effluents. They

were also taken to recycle installations and the plant for caprolactam recovery from solid caprolactam wastes and caprolactam waste water, at caprolactam filament and fiber production facilities.

On the 23d of June 1975 the US delegates visited Almalyk fertilizer plant.

The meeting was attendad by mr. K.G. Sadikov - plant director and by U.S. Tadzhiyev - deputy director. Mr. K.G.Sadikov gave information on the range of chemicals produced by the plant and the various measures adopted in the field of environmental protection. The US specialists saw the vent gas and dust purification plant (scrubbers, venturi apparatus, cyclones). The closed-circuit water recycle system with the reuse of treated and clarified effluents put on stream at the complex for the first time in wet process phosphoric acid and ammonium phosphate production processes caused the interest of the US specialists and was highly appraised by them.

The effluent treatment plant operation along with the reuse of clarified waste waters in a closed-circuited recycle system has shown that wide application of this method at phosphate fertilizer plants will make it possible to get rid of contaminated water discharges.

On the 25th of June 1975 the US delegation visited the All-Union Research Institute of Synthetic Fibers (VNIISV) in Kalinin and inspected the municipal effluent (waste water) treatment plants. These facilities treat effluents from industrial plants including those of Kalinin complex of chemical fibers. The delegation was received in the Institute by

Mr. V.M.Kharitonov - deputy director who gave a brief outline of the Institute activity, structure and principle scientific trends.

The meeting was attended by mr. Kvasha - head of labor protection department, mr. L.P. Slavgorodsky - head of toxicology laboratory, mr. A.T. Kotlovoi - head of the section for vent exchaust purification who briefly described principal achievements at the Institute in the field of environmental protection.

On the 26th of June 1975 the US delegates visited the Kuryanov aeration station establishment-one of the complexes of the Moscow sewerage and waste water treatment system. Mr. S.J. Bikov - head of the establishment familiarized the US specialists with the waste water treatment and precipitate (residue) processing flowsheets. The delegation examined mechanical and biological purification plants as well as an experimental plant for the precipitate (residue) vacuum filtration and thermal drying.

During the meetings and discussions both sides were pleased to note the expediency of joint efforts when solving common problems facing chemical industries at the both countries in the field of environmental protection.

A copy of the proposal to the draft program of scientific-technical cooperation in the field of enviromental protection between the USSR and USA for 1976 within framework of the US-USSR Joint Committee on Cooperation in the Field of Environmental Protection is attached as Appendix 4.

This proposal will be considered and reviewed upon the return of the U.S. delegation to the United States. In addition the specific U.S. corporations referred to in the proposal will be contacted. The Envirenmental Protection Agency will solicit their interest and desires pertaining to the 1976 proposal of the Ministry of the Chemical Industry. The U.S. delegation supports the proposal in principle and feels that our respective chemical industries can engage in a mutually advantageous continuing exchange of waste water treatment and management technology. It is expected that a firm proposal for 1976 will be available for review at the fourth session of the Joint US-USSR Commission to be held in Washington D.C. during October 1975.

The both sides have agreed to exchange proposals on expanding environmental protection cooperation with regard to the other branches of chemical industry.

The both sides note that all the formal and informal meetings and discussions were held in a friendly atmosphere and were aimed at further broadening and strengthening of contacts.

As part of this official memorandum, the chairman of the American delegation would like to acknowledge the outstanding courtesies afforded by our Soviet escorts.

The memorandum is signed on June, 27, 1975 in Moscow in Russian and English with both texts of the same validity.

On behalf of the delegation
of the Ministry for Chemical
Industry of the USSR
Konstantin K.Cherednichenko
Vice- Minister

Chairman of the US
delegation
Andrew Paretti
Consultant Water Program
Operations
EPA

DELEGATION TO TOUR THE SOVIET UNION -
JUNE 15 - JUNE 28, 1975

TOUR OF THE MINISTRY OF THE CHEMICAL INDUSTRY - UNDER THE WORKING GROUP FOR THE PREVENTION OF WATER POLLUTION FROM INDUSTRIAL AND MUNICIPAL SOURCES

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Appendix 2

DELEGATION

of the specialists of Ministry for chemical industry (MCI)

1. Mr.Konstantin K-Tcherednichenko - Leader of the delegation Vice-Minister of the chemical industry
2. Mr.Vladimir F.Rostunov - Head of Science and Technology Directorate (MCI)
3. Mr.Nikolai F. Volkov - Deputy Head of the Foreign Relations Directorate (MCI)
4. Mr.Victor M.Milakov - Head of the Directorate (MCI)
5. Mr.Nikolai V.Snetkov - Deputy Head of the Directorate (MCI)
6. Mr.Andrei M.Aleshin - - " -
7. Mrs.Lyudmila F.Mokina - Department manager, Science and Technology Directorate
8. Dr.Dmitri S.Gorbenko-Germanov - Head of Environmental protection Laboratory (MCI)
9. Prof. Vasili M.Borisov - Director of NPK Research Institute
10. Mr. Ivan G.Shimko - Director of the Institute of Artificial Fibers
11. Mr.Ivan M.Tanchenko - Director of Research and Design Institute of Domestic (Household) chemistry plants
12. Prof. Alexander S.Tchegolya - Director of Scientitic Research Institute of Synthetic Fibers
13. Mr.Yu,N.Sapov - Chief Engineer of Leningrad Research and Design Institute

Appendix 3

P R O G R A M

of the stay in the USSR of the US specialists on water effluent treatment in chemical plants

Period of stay: from 15 to 28 June 1975
Number of specialists: 5

Date and time	Program description
15th June 2nd day	Landing at Sheremetyevo airport Trip to Moscow and accomodation in the hotel
16th June 3d day 10 a m	Visit to NPK fertilizer scientific research institute and exchange of information on environmental protection when making mineral fertilizers
13-00	Break for lunch
15-00	Meeting with Mr.Konstantin K.Tcherednichenko - Vice-Minister of the chemical industry
19-00	Visit to the Moscow theatre
17th June 4th day 10 a m	Visit to Scientific Research Institute of Artificial Fibers Meeting with the Institute director, familiarizing with institute activities and information exchange on environmental protection when making artificial fibers
13-00	Break for lunch
14-00	Visit to the Institute computer center, library and the "Nature protection" Museum
15-30	Discussion of technical and scientific cooperation in the field of environmental protection
21-25	Departure to Kiev by train
18th June 5th day 9 a m	Arrival in Kiev, meeting at the station and hotel accomodation

1	2
12-00	Visit to Scientific Research and Design Institute of Domestic and Household Chemistry
	Meeting with the Institute director, familiarizing with the Institute activities and discussion on environmental protection when making household chemistry products
15-00	Break for lunch
16-00	Visit to the Institute laboratories engaged in making synthetic detergents for Varions applications
19-00	Visit to the Kiev Theatre
19th June 6 th day 10 a m	Visit to domestic and household chemistry headquarters
	Meeting with the director-general of the corporation, visit to the industrial facilities of the Kiev domestic and household chemistry factory
15-00	Break for lunch.
16-00	Kiev sightseeing
20th June 7 th day 10 a m	Visit to Kiev chemical fiber complex.
	Meeting with the complex director, visit to water treatment, gas purification and caprolactam recovery facilities
15-00	Break for Lunch
22-25	Departure by train to Moscow
21th June 8th day 11 a m	Arrival in Moscow
15-00	Take-off for Tashkent from Domodedovo airport
22-00	Landing at Tachkent airport and hotel accomodation
22nd June 9 th day	Trip to Samarkand

1	2
23d June 10 th day 10 a m	Trip to Almalyk Fertilizer plant Meeting with the plant director, visit to theextraction, fluorine containing gases and acid effluent treatment facilities.
14-00	Break for lunch
16-00	Return to Tashkent
24th June 11 th day 9.58 a m	Take-off from Tashkent for Moscow
14-00	Landing at the Moscow airport, hotel accomodation
25th June 12th day 10 a m	Visit to Kalinin Scientific Research Institute of Synthetic Fibers, meeting with the Institute director, Tour round the laboratories and experimental plant
14-00	Break for lunch
17-00	Visit to the Kalinin municipal effluent treatment plant
26th June 13 th day 10 a m	Visit to the Moscow municipal effluent treatment plant
27th June 14 th day 10 a m	Final meeting with Mr.Konstantin K.Tcherednichenko - Vice-Minister of the chemical industry, discussion concerning the results of the visits to the MCI establishments and prospects of the future cooperation development
17-00	Reception in honour of the American delegation
28th June 15 th day	Take-off for the USA from Sheremetyevo airport

Appendix 4

P R O P O S A L S

to the draft program of scientific- technical cooperation in the field of environmental protection between the USSR and USA for 1976 within the framework of the Soviet- American commission

It is suggested that the program should include:

1. Visit of the Soviet delegation (7 people) to the USA in the first half of 1976 for 14 days (number of people to be delegated from each branch of chemical industry is indicated in the draft.

2. Visit of the American delegation (7 people) to the USSR in the second half of 1976 for 14 days.

1	Subject	Objective and results expected	MCI organizations	Organizations and companies in the USA	Number of Soviet specialists to be delegated
1	2	3	4	5	6
	I. House hold (domestic) chemistry				
1.	Study of the experience in designing and operation of local and complete effluent treatment plants (for the removal of surface-active agents) at synthetic detergent factories	Improvement of the plants under design and modernization of existing effluent treatment plants in order to reduce the amount of harmful wastes in the effluents	All Union Corporation for household (domestic) chemistry (V/O "Soyuzbitkhim") Household chemistry research and design institute (VNIIKHIM-Proyekt)	Colgate--Palmolive Company; The Procter and Gamble Company	2

1	2	3	4	5	6
2.	Study of the control methods of the effluents when making synthetic detergenty	Improvement of control methods of liquid effluents when making synthetic detergents			
	II. Production of chemical fibers:				
3.	Study of the experience in designing and operation of:				2
	a) rayon fiber and film factories and effluent treatment plants	Improvement of existing systems. Reduction of raw material and water specific consumption rates. Provision of adequate environmental protection by development of effluent- free systems	All Union Corporation of chemical fibers (V/O "Soyuzkhimvolokno" Scientific Research Institute of artificial fibers (VNIIV)	FMC Corporation, Olin Corporation, E.I. Du Pont De Remours and Co.Inc	
	b) effluent treatment plants at acrylic fiber factories	Improvement of existing production facilities with the view of reducing waste discharges into basins and development of effluent - free production facilities		Cyanamid Corporation	

1	2	3	4	5
4.	Computarization of ~~production~~ tion chemical fiber process control and application of automated control systems for the operation of effluent treatment plants.	Improvement of existing production facilities with the view of improving the product quality, productivity growth and provision of adequate environmental protection by means of complete automation of recovery (regeneration) units.		E.I.Du Pont De Nemours and C. Inc.
5.	Introduction to carbon fiber and high modulus organic fiber production processes with the view of developing recovery (regeneration) processes of the effluents from these production facilities.	Development of new technological systems for trapping harmful substances and construction of effluent-free production facilities with closed circuit water recycles.		- " -
6.	Study of the methods for the effluent treatment of chemical fiber production facilities with the view of their rense (electric dialysis, hyperfiltration, adsorption).	Development of local methods of effluent treatment with the view of water reuse.		Aqua-Cell Company, Dow Chemical U.S.A. FMC Corporation

1	2	3	4	5	6
III. Production of mineral fertilizers					
7. Study of designing and operation experience of effluent treatment plants of yellow phasphorus operations	Improvement of the plants under design and modernization of existing effluent treatment plants with the view of reducing the amount of harmful wastes in the effluents	TVA I Farmers Chemical Company, Cooperatives International and Mining			1

Two MCI representatives are included additionally into the delegation with the view of expanding cooperation scope on other chemical productions.

On the State of Water Use and Effluents Treatment in the Manufacture of Man-Made Fibers

(O.P.Vasiljeva)

The enterprises of our branch of industry are in the majority of cases plants for the manufacture of man-made fibers. They combine the synthesis of polymer, sometimes it is proceeded by the synthesis of monomer, the production and partial processing of the fiber, solvent regeneration, liquid and solid wastes processing.

The effluents from all industrial plants are subjected to the whole complex of biological treatment separately or simultaneously with the domestic or other kinds of effluents.

In the USSR 4 types of water is employed in the production of man-made fibers including river (filtered), softened, demineralized and drinking water. The river filtered water is generally used for those operations where water doesn't come into contact with raw materials, intermediate products (for example, to cool the apparatus through the walls), the softened water and demineralized one are used directly in the production process, chemical reactions (for the solvent preparation, finished fiber washing, etc.).

Rates of water rase and standards for water quality are given in tables (1-2).

To prepare water for the production use the following processes are employed in the USSR:

1. Filtration with the help of sand and gravel filters, sometimes using organic and inorganic coagulators and flocculants to produce primary water;

2) Water softening by means of cationite filters (sulphonic-acid carbon, KU-2).

3) Demineralization of water using cationite-anionite filters or distillation to produce demineralizes water.

In the Soviet Union water reuse is of wide application at man-made fiber plants. Firstly, all the water employed for cooling apparatus through the walls is in the return systems of water supply, which are equipped with the cooling towers. Secondly, the water which comes into contact with the chemical reaction producte is generally reused in the technological processes until the amounts of impurities in it are attained corresponding to the calculated concentrations. Such systems are normally related to the recovery of the products coming to water on attaining the above concentrations in the water at the plants for vacuum evaporation, extraction, etc.

The standards for water quality in the return systems of water supply are given in table 3. The standards for reused water quality employed directly in the production process in each particular case are determined by the technological conditions.

In the last few years at some enterprises the water supply system is employed wherein the treated effluents are used subjected to after-treatment in the biological ponds and inorganic coagulators treatment followed by filtration.

In the USSR the effluent treatment at man-made fiber plants is generally afforded by the complex of units for biological treatment (capacity 50.000-150.000 m^3/day), including 3 steps: mechanical treatment on the grids, sand traps and in the settling tanks (1-st step.). 2-nd step- biochemical treatment in the air tanks and the 3-rd - disinfection by means of chlorination. At some plants the above effluents are subjected to the after - treatment in

the biological ponds. The above method assured a quality of treatment corresponding to data given in Table 4.

In the USSR the development of water supply system and water disposal system with maximum water return has become a problem of today due to the exhaustion of selfpurification of some water basins. The above problem is to work for our branch of industry too.

In the light of recent requirements in VNIISV and GIPROIV the complex system for the effluent treatment with maximum water return is being developed in relation to the polyamide fibers, the production process of which is characterized by the large amounts of water consumption. Later on this kind of work will extend to the fiber of different types.

Concurient with the widely accepted in our branch of industry biological method of treatment, the above complex systems will also include the mechanico-chemical methods of effluent treatment. The methods are as follows: pressure floatation and filtration on the filter element from nonwoven materials intended for removing lubricant components from the effluents; ion exchange and back osmosis for demineralization; ozonization intended for oxidation of the small amounts of organic substances in the effluents and other methods which are at the stage of promotion.

In addition to the methods of treatment the works directed to the development of endorheic production plants will necessarily include the technological aspects, i.e. development and improvement of such production processes, which decrease or completely exclude the formation of effluents. The above works are carried out with success in VNIISV and at the plants and are expected to extend.

We are informed that simil r problems are currently central in your country too. We believe that wide exchange of information and cooperation of our countries will assist in advantageous solving the problem of nature protection from the industrial sewage water.

Требования к качеству потребляемой воды в производстве волокна капрон, анид, лавсан, нитрон.

Таблица №1.

Вид потребляемой воды.	Наименование показателей и единица измерения.									
	Цветность в платино-кобальтовой шкале	Прозрачность по Снеллену 3 см	Активная реакция pH	Щелочность в мг-экв/л.	Общее солесодержание	Окисляемость мг O_2/л.	Жесткость мг-экв/л		Железо мг/л	Марганец мг/л.
							Общая	Карбонатная		
1. Речная осветленная вода.	до 20	более 10	7,1-7,7	5,5	500	до 10	6,0	не более 5,5	до 0,3	до 0,1
2. Умягченная вода.	до 10	более 20	7,1-7,7	до 5,5	500	до 4	0,035	—	0,05	0,03
3. Обессоленная вода.	общее количество растворенных солей 1,0-1,5 мг/л.									
4. Питьевая вода.	ГОСТ 2874-54									

Удельные расходы и характеристика воды и сточных вод производства синтетических волокон.

Табл 2 (1)

Потребители воды и источники поступления сточных вод.	Удельный расход воды в м³ на 1 т продукции.		
	Фильтрованная		Умягченная
	t° = 25	t° = 40	
Производство волокна капрон.			
Химический цех	230-250	90-100	20-25
Цех регенерации.	140-150	—	2-3
Прядильно-отделочный цех	120-130	230-250	100-110
Производство волокна анид.			
Все цеха основного производства	220-230	100	30-40

Сточные воды.

Потребители воды и источники поступления сточных вод.	Загрязненные			После охлаждения пригодные для повторного использования	Условно чистые, сбрасываемые в канализацию
	Основные загрязнения				
	Удельный расход в м³/т	Наименование	Концентрация мг/л.		
Производство волокна капрон.					
Химический цех	35-40	Капролактам	130-140	220-300	5-10
Цех регенерации	2-3	Следы капролактама, кислот, щелочей.	—	140-150	3-5
Прядильно-отделочный цех	120-130	Капролактам, замасливатели	100-200 120-130	300-320	10-20
Производство волокна анид.					
Все цеха основного производства.	10-20	В том числе 2 м³/т, загрязненные гексаметилендиамином с концентрацией 2-3 г/л.		210-200	20-40

УДЕЛЬНЫЕ РАСХОДЫ ВОДЫ И СТОЧНЫХ ВОД ПРОИЗВОДСТВА СИНТЕТИЧЕСКОГО ВОЛОКНА ЛАВСАН С ИХ ХАРАКТЕРИСТИКОЙ.

Табл 2 (2)

Потребители воды и источники поступления сточных вод.	Удельный расход воды в м³ на 1т продукции		
	Фильтрованная		Умягченная
	$t_в$ = 25°C	t = 10°C	
Химический цех	1-2	190-210	12-15
Прядильный цех	70-75	180-185	8-10
Цех регенерации смолы	—	18-20	6-8
Цех регенерации растворителей	10-12	60-65	—

Сточные воды.

Потребители воды и источники поступления сточных вод.	Загрязненные			После охлаждения, пригодная для повторного использования	Условно чистые, сбрасываемые в канализацию
	Удельный расход м³/т	Основные загрязнения: Наименование	Концентрация мг/л.		
Химический цех	10-12	Метанол, этиленгликоль	600 500	170-180	23-25
Прядильный цех	3-5	Полимер	60	230-240	8-10
Цех регенерации смолы	4-5	—"—	40	18-20	1-2
Цех регенерации растворите-	10-12	Метанол, этиленгликоль	200 150	60-65	2-3

Удельные расходы воды и сточных вод с качественной характеристикой для производства волокна нитрон (по солевому методу).

Табл 2 (3)

Потребители воды и источники поступления сточных вод.	Удельный расход воды в м³ на 1т продукции		
	Фильтрованная		Обессоленная
	t = 25°C	t = 10°C	
Цех растворения, фильтрации, полимеризации.	5-8	3-5	5-6
Прядильно-отделочный цех.	220-230	—	55-60
Цех регенерации.	450-460	3-5	5-6

Сточные воды.

Потребители воды и источники поступления сточных вод.	Загрязненные			После охлаждения, пригодные для повторного использования.	Условно чистые
	Удельный расход м³/т	Наименование загрязнений	Концентрация мг/л		
Цех растворения, фильтрации, полимеризации.	10-12	НАК, полимеры	200-220 470-480	—	5-7
Прядильно-отделочный цех	60-70	НАК	200-220	190-220	5-10
Цех регенерации.	40-50	НАК, роданистый натрий, полимеры, Nосе, нсе	200-220 200-210 470-480 250-270, 60-70	400-410	5-10

4

1	2	3	4	5
ПРОИЗВОДСТВО ВОЛОКНА-НИТРОН				
А. ФИЗИЧЕСКИЕ ПОКАЗАТЕЛИ:				
Температура	°С	25-30	20	
Прозрачность по Шрифту	см	1,5	9,5	
Взвешенные вещества	мг/л	807	29,6	
Масла и смолообразные продукты (эфирорастворимые)	—"—	91	отс.	
Б. ХИМИЧЕСКИЕ:				
pH		7-13	7-8	
Жесткость общая	мг-экв/л	35-55	35-55	
Щелочность общая	—"—	57	54	
Общее солесодержание	мг/л	до 1100		
Cl^-	—"—	70	0,3-15	
SO_4	—"—	90	0,3-15	
Ионы тяжелых металлов - медь	—"—	1-15	0,35	
В. БИОЛОГИЧЕСКИЕ				
$БПК_5$	мгO_2/л	1200	245-50	
ХПК	—"—	3000	200	
Биогенные элементы	мг/л	4000		
Фосфор (в пересчете на P_2O_5)	—"—	5-12	до 1	
Азот	—"—	20	1-2	
Г. СПЕЦИФИЧЕСКИЕ				
ТОКСИЧНЫЕ ВЕЩЕСТВА:	мг/л			
Цианиды	—"—	20-30	0,05-0,2	
Роданиды	—"—	30	отс.	
ПАК	—"—	до 500	отс.	
Метанол	—"—	68	отс.	
ФЕНОЛПРОИЗВОДНЫЕ				
Фенолы	—"—	33-100	до 0,05	

Табл 2 (5)

1	2	3	4	5

ПРОИЗВОДСТВО ВОЛОКНА ЛАВСАН

А. ФИЗИЧЕСКИЕ ПОКАЗАТЕЛИ:

Температура	°С	20-25	18-24	
Прозрачность по Шрифту	см	4,6-8	15-20	
Взвешенные вещества	мг/л	35-190	8-16	
Масла и смолообразные продукты (эфирорастворимые)	—"—	56-118	7-15	

Б. ХИМИЧЕСКИЕ

pH		6,8-7,7	7,4-7,8	
Жесткость общая	мг-экв/л	7,6	6,0	
Щелочность общая	—"—	6,5	7,0	
Сухой остаток	мг/л	544-770	380-540	
Прокаленный остаток	—"—	270,5	559	
Cl	—"—	15-160	10-82	
SO_4	—"—	19-31	9-17	
Fe общее	—"—	5,8	2,0	

В. БИОЛОГИЧЕСКИЕ

$БПК_5$	$мгO_2/л$	198-780	9-12	Биологи-
ХПК	—"—	1030-3190	40-85	ческий
Биогенные элементы:	—"—	5-7	0-1	
фосфор (в пересчете на P_2O_5) азот		17-20	1-2	

Г. СПЕЦИФИЧЕСКИЕ

Вещества, мешающие повторно-	мг/л		
му использованию ст. вод			
Метанол		84-120	0-2
Этиленгликоль		31-125	отс.
Токсичные в-ва: формальдегид	—"—	11,6-16,5	0,1-0,8
п-ксилол		8-28	отс.

3

Норм[illegible] требования к ка[illegible] воды в системах повторного и оборотного водоснабжения предприятий промышленности химических волокон /синтетические волокна/.

Таблица N 3

№ п/п	Наименование показателей качества воды.	Единица измерения	Вода, используемая для охлаждения оборудования и продуктов в теплообменных аппаратах, работающих при t-ах охлаждения продукта али степени
1	2	3	4
	Производство волокна капрон, анид, лавсан, нитрон.		
	А. Физические:		
1.	Температура	°C	25-26
2.	Взвешенные вещества	мг/л	10-15
3.	Эфирорастворимые вещества	мг/л	до 5
4	Запах	баллы	не нормируется
5	Цветность	градусы платино-кобальтовой шкалы	не нормируется
	Б. Химические:		
6	PH		7-8
7	Жесткость общая	мг-экв/л	не нормируется
8.	Жесткость карбонатная добавочной воды	—"—	до 30
9.	Щелочность общая	—"—	до 30
10	Общее солесодержание (сухой остаток)	мг/л	до 2000
11	Хлориды	—"—	200-300
12	Сульфаты	—"—	до 500
13	Железо	—"—	до 1
14	Ионы тяжелых металлов	—"—	не нормируется
15	Поверхностно-активные вещества	—"—	
16	Вещества, растворимость которых уменьшается при нагревании	—"—	не нормируется
	В. Биологические x		
17	Окисляемость перманганатная	мг O_2/л	до 10
18	БПК	—"—	до 10
19	ХПК	—"—	20-30
20	Биогенные элементы – азот xx и фосфор (в пересчете на P_2O_5 и N)	мг/л	0,5
	Г. Специфические:		
21	Мешающие вещества	мг/л	не допускается
22	Токсические вещества xx	—"—	—"—
23	Пирофорные вещества	—"—	—"—
24	Вещества, выделяющиеся при нагревании с образованием огне- и взрывоопасных смесей	—"—	—"—

x) В пределах, исключающих биологические обрастания трубопроводов.

xx) Нормируется в каждом отдельном случае в зависимости от технологического процесса.

4. (СОСТАВ ЗАГРЯЗНЕНИЯ) СТОЧНЫХ ВОД, ВЫПУСКАЕМЫХ В ВОДОЕМЫ ПРЕДПРИЯТИЯМИ (ПО ДАННЫМ ДЕЙСТВУЮЩИХ ПРЕДПРИЯТИЙ ПРИ СОВМЕСТНОЙ ОЧИСТКЕ С ГОРОДСКИМИ СТОКАМИ).

Таблица №4.

Наименование показателей качества сточных вод, выпускаемых в водоемы	Единица измерения	До очистки	После очистки	Метод очистки
1	2	3	4	5
Производство	**Волокна**	**Капрон**		
А. Физические показатели				
Температура	°С	20-25	13-20	
Прозрачность по Шрифту	см	4-8	15-20	
Взвешенные вещества	мг/л	88-220	5-15	
Масла и смолообразные продукты (эфирорастворимые)				
Запах холодной и нагрет. воды				
Б. Химические:				
pH		7-8,4	7,4-7,9	
Жесткость общая	мг-экв/л	3,5-6,4	4,5-6,8	
Щелочность общая	—"—	2,4-5,0	4-6,3	
Сухой остаток	мг/л	500-800	669-740	
Прокаленный остаток	—"—	100		
Ca^{2+}	—"—	80		
Cl^-	—"—	30-300	80-103	
SO_4^{2-}	—"—	8,7	66	
Fe общ.	—"—	4,0	0,5-1,5	
Поверхностно-активные вещества	—"—	5-15	0,5-1,5	
В. Биологические				
Окисляемость перманганатная	мг O_2/л	64-100	8-13	
$БПК_5$	—"—	200-340	3-9	
ХПК	—"—	423-1233	25,5-80	
Биогенные элементы-фосфор	—"—	3-5	0-1	
(в пересчете на P_2O_5 и азот)	—"—	17-20	1-2	
Г. Специфические:				
Вещества, мешающие повтор-ному использованию стока — капролактам.	мг/л	50-124	следы	Биохи-мический
Токсичные вещества	—"—	0,3-0,46	0,03	Биохи-мический